

# Some Landmarks in Surgical Technique

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*Address to Students, opening of Winter Session 1947-48, Royal Victoria Hospital, Belfast*

IN welcoming the students who are coming to hospital for the first time and those who have already attended the hospital, I am carrying on a tradition which has extended for over sixty years. It is recorded in the staff minutes of 2nd October, 1883, that Dr. Whitla moved and Dr. Byers seconded that the winter session be inaugurated with an address by a member of the staff. Some of the staff did not agree with this and an amendment was moved by Mr. Fagan, seconded by Dr. Moore, to the effect that the session be opened by an ordinary clinical lecture and that the introductory be postponed until next year, but on being put to the vote, the motion was carried and Dr. John Moore gave an address on the following 3rd November. One wonders if Dr. Moore supported the amendment because he had to give the address. He was a busy man and I can appreciate his feelings. All were famous members of the staff. Dr. Whitla, Dr. Byers, and Mr. Fagan in the course of time were knighted, and Sir Wm. Whitla's name lives in the school by the Whitla Medical Institute and the Whitla Hall at the University, and the Vice-Chancellor's residence, all three projects due to his munificent benefactions. I am therefore the sixty-fifth member of the staff to give the opening address. It is of interest that there were then one hundred and sixty-four medical students attending the hospital. To-day we have two hundred and eighty medical and twenty-seven dental students.

Before commencing my address it is my pleasant duty to give a welcome to the recently elected members of the staff. First Mr. Harold W. Rodgers, O.B.E., who joins the staff by virtue of his election as Professor of Surgery. Professor Rodgers comes to us from St. Bartholomew's Hospital, where he was Assistant Surgeon. Professor Rodgers served in the army as a surgical specialist for more than six years and was awarded the O.B.E. for his services in Italy and in North Africa. In offering him a cordial welcome may I wish him a long and happy tenure of office. He comes to a Chair with great traditions. Within living memory it has been held by Gordon, Sinclair, Fullerton, and Crymble, all names that are held in respect by Queen's men. Professor Crymble leaves us amid general regret. He has been associated with the hospital as Assistant Surgeon and Surgeon since 1919 and as Professor of Surgery since 1933. In all these offices he has served with great advantage to the school and credit to himself. Dr. M. G. Nelson is another recruit to the staff whom we welcome this morning. After serving for over five years in the R.A.F., Dr. Nelson has been appointed full-time Clinical Pathologist to the hospital, and I have much pleasure in giving him a hearty welcome to the staff.

Students coming to hospital for the first time might think the assemblage of so many sick people very depressing, but it has its cheerful side when we consider

how many of them, restored to health through the ministrations of the hospital, are enabled to resume their places in the busy world and in their homes.

For the purpose of this morning's address I propose to consider an everyday series of events in the hospital and one which any student with an enquiring mind—and I hope all of you have enquiring minds—would wonder how these were evolved. I refer to the methods of surgeons preparing to operate. Minor differences will be noticed, but in the main, one broad principle guides them all—to render themselves surgically clean, to keep their patients and the field of operation as far as possible immaculate also. It is appropriate that we should mark this, for it is just one hundred years since the first concerted effort was made to render the hands clean and to prevent infection amongst patients from unclean hands. It is strange to reflect that twenty years should have elapsed between the discovery of the virtues of hand-washing in 1847 and the introduction of antiseptics in 1867, seeing that the underlying principle is the same.

The person responsible for the systematic washing of the hands was Ignaz Phillip Semmelweiss, a Hungarian born in Budapest in the year 1818. He received part of his education in Vienna and in course of time became first assistant to the Professor of Midwifery in that city. The Obstetric Hospital in which he worked is still in use and his activities in Vienna are marked by a bronze plaque, which I have often seen and admired. This records his name, age, and fame. A statue was also erected to him in a public square in his native city of Budapest, about fifty years after his death. It was not his fortune to have his merits and work recognised in life, and his teaching as to the cause of puerperal fever and its prevention accepted. Had it been so it is possible that, as Sir Wm. J. Sinclair says, instead of giving antiseptics to midwifery twenty years later, midwifery would have been the beneficent donor to surgery in 1847.

Briefly the story is this. The Vienna school had a sinister reputation for maternal deaths due to puerperal fever, especially in the years 1822 to 1847, and it was due to the genius of Semmelweiss that the cause was discovered and measures taken to defeat it. Five to seven thousand patients per annum were delivered in the Maternity Hospital and the death rate from puerperal sepsis alone ranged from two per cent. to fifteen per cent. in its different sections. Note that the figures of maternal mortality are per hundred and not per thousand, as we are accustomed to think of it. To-day's rate is three to four per thousand from *all* causes. Anything over five per thousand, i.e. one in two hundred, would provoke anxious comment. The hospital was divided into two divisions, one for the training of medical students and the other for nurses. The death rate for the students' department always had an unenviable pre-eminence, ranging from six per cent. to fifteen per cent. The nurses' death rate ranged from two per cent. to seven per cent., and high as the figures were, they were much below the students'. The difference in the death rates in the two departments was so well known to the general public in Vienna that it was quite a common occurrence for a patient on being admitted to hospital to get down on her knees and beg to be sent to the nurses' division rather than to the students'. It is almost certain that this does not include the

deaths of women suffering from puerperal fever who were transferred to the General Hospital and died there, so that the statistics are even worse than they seem. Those who are familiar with puerperal fever, especially before the introduction of the sulphonamide drugs, will remember two classes of cases—those who died after a few days' illness and those who lingered for weeks.

Semmelweis described the various theories which were supposed to govern the onset of puerperal sepsis, which were current at the time. None satisfied him, and then a great light was shed on the problem. His friend, Kolletschka, Professor of Jurisprudence, died from a prick received at a post-mortem. Semmelweis was already familiar with post-mortem appearances in deaths from puerperal sepsis. Let him tell in his own words the impression that Kolletschka's death made upon him. "Day and night," he says, "a vision of Kolletschka's malady haunted me and with ever-increasing conviction I recognised the disease from which he died with the malady which I had observed had carried off so many lying-in women."

At one stroke he solved the dual problem: the comparative immunity in the nurses' department from sepsis and the occurrence in such numbers in the students' department. The students were coming direct from the dissecting room and post-mortems to the labour ward and examining patients without efficiently cleansing their hands. The nurses had no contact with such sources of infection. Once Semmelweis had grasped this fact he instituted hand-washing and disinfection of the hands with a solution of chlorinated lime. This was in May, 1847, and during the remaining months of 1847 the maternal mortality was three per cent. compared with 11.8 per cent. in 1846. In 1848, when hand-washing was in full operation for the whole year, forty-five patients out of three thousand five hundred and fifty-six died in the students' department, that is, 1.27 per cent. For the first time in the history of the Vienna Lying-in Hospital the students' division had a lower mortality than the nurses'. In March and August of 1848 there were no deaths whatsoever from puerperal sepsis.

Semmelweis when he made his important discovery of the cause and prevention of puerperal sepsis was only twenty-nine years of age. It would be comforting if I could tell you that his success was hailed in the world of obstetrics as a great advance, but, beyond a few schools, he made little headway, and finally, disgusted with his treatment in Vienna, he returned to Budapest, where he was appointed Professor of Midwifery with charge of the hospital. It is certain that his treatment in Vienna and the opposition of some of his senior colleagues was a great disappointment to him. He had proved beyond a doubt that the disease was conveyed from the mortuary to the patients and from patient to patient and that the vehicle for its transmission was the hand of the student. What he did not recognise was that there were many other sources of infection equally potent and that the "cadaveric particles," as he called them, were not the whole story.

Four years previously, in 1843, Oliver Wendell Holmes had read a paper in Boston on the contagiousness of puerperal fever, in which he contended that a woman in child-birth should never be attended by a physician who had been conducting post-mortems, or who had an infected midwifery case under his care, and

that if he had such a case his clothes should be changed, the hands washed in chloride of lime solution before attending another case. He was ridiculed, especially by the two leading American obstetricians, Meigs and Hodge, but in 1853 he returned to the charge with another paper entitled "Puerperal Fever, a Private Pestilence," in which he reiterated his views and recorded that a Hungarian, Semmelweiss, had lowered the mortality in his hospital by simple washing of the hands with chloride of lime solution and a nail-brush. This shows how circumscribed the medical world was a hundred years ago, eight years elapsing between Semmelweiss's discovery and the knowledge of it by Holmes.

Semmelweiss is the true pioneer of antiseptics in midwifery; while Holmes had made his observations four years earlier, Semmelweiss, not knowing of Holmes' paper, recognised puerperal sepsis in its true colours, as a blood poisoning or septicaemia. It is said, not without truth, that there is a black chapter in the history of medicine and it is headed "Semmelweiss." We cannot imagine the acrimony that marked the controversies between medical men a century ago. Semmelweiss, towards the end of his life, wrote a series of open letters to various German professors who opposed him. In a letter assailing the teaching of one of them, Scanzoni of Wurzburg, he writes, "Your teaching, Herr Hofrat, is based on the dead bodies of lying-in women slaughtered through ignorance. I denounce you before God and the world as a murderer and the history of puerperal fever will not do you an injustice when it perpetuates your name as a medical Nero." For a fortnight before his fatal illness overtook him he had been strange in his manner, and his wife and his old friend, Professor Hebra, took Semmelweiss from Budapest to Vienna. He was admitted to the Asylum and there a little cut in his finger became infected and he died of an acute sepsis, as did his friend Kolletschka, eighteen years previously, and, strangely enough, in the same room where Kolletschka had lain they performed a post-mortem on Semmelweiss, confirming that his death was due to septic infection.

We now pass to a different man and a different scene—Joseph Lister. He was born in 1827, nine years after Semmelweiss, at Upton House in Essex, now part of London, in the Borough of East Ham. His father was a prosperous wine merchant in London, who won distinction in the study of optics and was made a Fellow of the Royal Society, in which he was joined in his lifetime by his son, Joseph, so that father and son were contemporaries in the Fellowship of the Society. The son gained his admission as a Fellow at the early age of thirty-three. Joseph Lister was a great contrast to Semmelweiss. A Quaker with a Quaker's moderation of language, gentleness, patience, and a dislike of controversy, he yet convinced his generation of the essential merits of his system. To-day it is difficult for us to visualize what surgery was before Lister.

It has been truly said that surgery may be divided into two great divisions—that before Lister and that after him. In the days before Lister's system, in the main only operations directly contrived to conserve life were undertaken. All operations of expediency were frowned on. Even those undertaken to conserve life, although they might remove the immediate risks, too often resulted in death

from another avenue—acute sepsis. I have time for one example only. In the Franco-Prussian War the mortality among the French wounded was appalling. Of every hundred soldiers who underwent amputations, even for minor wounds involving fingers and toes, ninety eventually died. The final figures of the Inspector-General, which were probably an understatement, recorded ten thousand and six deaths out of thirteen thousand one hundred and seventy-three cases of amputation.

Lister received his education at University College, becoming a Bachelor of Arts and finally taking his degree in Medicine and the Fellowship of the Royal College of Surgeons in 1852. In September, 1853, he went to Edinburgh with a letter of introduction to James Syme, who was then the leading surgeon in Great Britain, if not in the world. Syme made him a clinical assistant, then a house surgeon, assisting him in his private operations, and finally on the death of a Dr. McKenzie, he was appointed to the staff of the Edinburgh Royal Infirmary. He married Syme's daughter. Edinburgh was the home of controversy, but Lister kept as far away from this as possible and seldom or never was provoked into personal conflict with his rivals. His progress in Edinburgh was solid, if not spectacular, and in 1860 he was elected Professor of Surgery in the University of Glasgow, and in 1861 he was given charge of beds in the Royal Infirmary. Here as elsewhere the situation of surgical patients after operation was deplorable. Evil smelling wards, due to the great prevalence of sepsis—erysipelas, pyæmia, septicæmia, hospital gangrene, tetanus, all were rampant. In fact, Sir James Simpson, of anæsthetic fame, suggested burning hospitals down at periodic intervals. Of course this was impossible, and Lister set himself the more practical task of finding out how these dreadful conditions could be modified. It required a master hand to put the pieces of the jig-saw puzzle together and to evolve some order out of apparently unrelated phenomena. As long ago as the seventeenth century a Dutchman, Leeuwenhoek, the first microscopist, had already described minute bodies which are now known as bacteria. Then Lazzaro Spallanzani had discovered the presence of minute globules in the structure of yeast, and Cagniard de Latour in the year 1834 found that the fermentation, with which they were associated, was the direct product of their existence and formed a vital process. This view was discredited by the chemical explanations of Liebig. Louis Pasteur was eventually to prove that Cagniard de Latour was right.

Pasteur, who was five years older than Lister, was also able to point out that other fermentations, such as souring of milk and butter, were dependent upon and could be produced by living and multiplying organisms and that it was not the presence of air itself, but these dust-carried agents in it which contained microbes, which were responsible.

Meanwhile, it had been shown that by heat and filtration air could be deprived of its putrefactive powers and that there were certain substances that could check decomposition and suppuration in the human body.

Lister, carrying for the first time the full responsibility of his own wards, had stumbled almost by chance on Pasteur's work, and a great reformation began. This was in 1865. As Bashford put it, "Having already satisfied himself and

taught his students that pus in a wound meant decomposition of tissue, that this was somehow dependent upon, but not due to the air, and that there could be no wound infection without it, he now perceived staring him in the face, the explanation for which he had been striving. It was the micro-organisms that were in the air, that was the enemy, and, since, as he then believed, all were malign, to attack the citadel was insufficient; they must be destroyed before they entered the gates." He thought of many agents and finally settled upon carbolic acid, which was being used as a deodorant of sewage at Carlisle. It was taught that putrefaction was due to oxygen, which it was manifestly impossible to exclude, but it was shown by Pasteur that the septic property in the atmosphere depended not on the oxygen or any gaseous constituent, but on minute organisms in it. It occurred to Lister that decomposition in the injured part could be avoided by applying as a dressing some material capable of destroying the life of the floating particles, and in addition using a spray of carbolic which would purify the atmosphere. This was not, as Godlee says in his *Life of Lister*, an old struggle against putrefaction already established in the wound. It was an effort to prevent the occurrence of putrefaction in such wounds at all. I must quote again from Godlee, who has made it very clear. It had been shown that sterile urine could be kept from putrefying in a glass flask which had been sterilized and its neck hermetically sealed or the air admitted to it had been filtered, heated, or submitted to the action of an antiseptic substance. But if the cork be removed or the flask broken, or unfiltered, unheated, or untreated air admitted, putrefaction inevitably occurs. The skin is the flask in which our bodies are contained, a delicate covering almost as flimsy as glass. Let it be cut or lacerated and immediately a contest begins between our defensive living tissues and the deadly germs carried to the wound by the air, the surgeon's hands, or the instruments, unless the air, the surgeon's hands, and the instruments are purified by heat or an antiseptic chemical substance.

These minute organisms, of which Pasteur spoke and of which Lister was so alert to recognise the significance, are the whole family of microbes—the cocci, the bacteria, and all their numerous allies.

Of the common accidents those with compound fractures were the most difficult to treat, as they had a break of the skin, admitting air to the broken bones. At this time many compound fractures were amputated, harsh treatment as it may now seem, although many amputations ended as a compound fracture would have done—in severe sepsis. Lister himself recorded a mortality of forty-five per cent. in his own cases of amputation. The first case which Lister treated by his new methods was a compound fracture of the leg. It remained clean and healthy, and beyond some damage due to the antiseptic, gave him no anxiety. He treated eleven cases with one death and one amputation, and finally in August, 1867, read a paper in Dublin "On the Antiseptic Principle in the Practice of Surgery." Like all pioneers in medicine his views were received by those who understood with approbation, by his enemies with expressed scepticism, and by the great majority with indifference. It is interesting to note that one of the strongest of his critics was James Simpson of Edinburgh. This might have been a case of familial enmity, as

he was a great opponent of Syme, Lister's father-in-law. From 1867 Lister's wards in the Royal Infirmary in Glasgow, which were formerly the home of sepsis, became singularly free from it.

The cases of septicæmia, erysipelas, tetanus, and hospital gangrene were gone. He had visits from a few London men, while of continental visitors Lucas Championniere and Professor Saxtorph of Copenhagen were able to spread the gospel of antiseptics to the continent. Saxtorph, one year later, was able to report that he had no cases of blood poisoning in his charge and all the compound fractures with which he had to deal, some of them very severe ones, had healed without suppurating, and that all his amputations had recovered.

Thiersch of Leipzig was also in the field and his testimony came at a time when reinforcements were particularly welcome, although Lister had achieved by then the highest position in Scotland—Syme's Chair of Clinical Surgery in Edinburgh.

It is remarkable that all through the '70s the progress of antiseptic surgery had made small headway in these islands. In London only a few, notably Howse of Guys, afterwards President of the Royal College of Surgeons, and Marcus Beck of University College, were firm adherents. Sir Wm. Savory of St. Bartholomew's, one of the foremost surgeons in London and a bitter opponent of Lister's, considered that the annual average in his wards of about six cases of pyæmia, twenty of erysipelas, twenty-six of blood poisoning following injury, represented as good a result as it was possible to expect. He attributed the recent diminution in mortality to improvements in hygiene. Savory's address was described as the "Swan Song" of an already dwindling race of pre-antiseptic surgeons. It expressed, however, the views of a considerable proportion of senior members of staffs of the London and provincial hospitals at the time. As Godlee writes, "Like a poultice it warmed and comforted the soul of many middle-aged men, who had felt the discomforts of an undermined faith," although it made some of the younger men, to whom time passes but slowly, despair of the future. In the larger provincial hospitals progress was much quicker, as young men were more frequently advanced to the charge of wards.

Glasgow and Edinburgh had to wait for the advent of a new generation before reaping the fruits of antiseptic surgery. It is sad to read in the Life of Lister these words, "In Dublin and Belfast, the two principal surgical centres, leading surgeons with a few notable exceptions, either smiled at the innovation or ignored it." It is rather a reflection on British surgery that continental surgeons, notably the Germans, took up antiseptic surgery from the start; in fact von Bergmann, Thiersch, Volkmann, and others were amongst his strongest supporters.

The foreign tour which Lister took in 1876 was a triumphal procession. In 1877 Lister came to London as extra Professor of Clinical Surgery at King's College Hospital. Here his reception, to say the least of it, was cold. He had arranged to take his team from Edinburgh with him, two qualified house surgeons and two unqualified dressers, and the account of their reception at King's College is anything but flattering to King's. However, in time they wore down the opposition. It is remarkable, however, the slow progress that Lister's teaching in its early

years made in London. Even in Edinburgh he had no support from his colleagues on the senior staff, but he had many adherents amongst the juniors. After he left Edinburgh John Chiene and John Duncan did their best to follow his teaching amidst many difficulties.

In Glasgow, where the treatment had originated, one would have expected its success to be more immediate. All the surgeons, except one, affected to give the method a trial, but according to one of them "the thing was a sham." In 1874 Hector Cameron, afterwards Sir Hector Cameron, became one of the surgeons. He was thoroughly versed in Lister's methods and obtained equally good results.

Lister, it is recorded, found it hard to understand the indifference of his fellow-countrymen. Referring to the "flask experiment," he says: "I confess, Mr. President, I am ready to blush for the character of our profession for scientific accuracy when I see the loose comments sometimes made upon this experiment; and I am tempted to doubt whether some of the commentators can have enjoyed the advantages of sufficient education either in chemical physics or in logic."

Another notable contribution to surgery was made in 1869. For long the ideal ligature had been sought. Silk was almost invariably used and in pre-antiseptic days was left hanging out of the wound and finally sloughed out, not infrequently being attended by secondary hæmorrhage and quite often by suppuration.

Lister first used silk soaked in carbolic acid, which acted very well, and he even cut the silk short and left it buried in the wound, but an aneurism which he tied with silk and had an opportunity of examining ten months later, he found a few droplets of pus around the ligature, although the wound was apparently soundly healed. He thought of a more suitable animal material and tried catgut, which had been used before but had been given up as being unsatisfactory.

In December, 1868, at his father's house, with the assistance of his young nephew, Godlee, he got a calf and tied an artery in its neck in two places with catgut, which had been soaked for four hours in a watery solution of carbolic acid. A month later the calf, meantime having been in excellent health, was slaughtered. The original catgut had almost completely disappeared and its place had been taken by a new tissue formed by the invasion of its substance by cells from surrounding parts. The story of catgut is a long one and I do not propose to tell it here. Suffice it to say that Lister worked with catgut for almost the whole of his professional life. He used carbolic catgut first, but confessed in later years that he looked back with horror on some of his early procedures with it, for he did not then know how much the trustworthiness of catgut depended on the seasoning that comes with age. In the course of his endless experiments Lister tried many substances to sterilize and harden catgut—tannin, chromic acid, bichromate of potash, and others. He recommended chromic acid and carbolic acid for the preparing medium in 1881, but his final process consisted in treating the gut with chromium sulphate and corrosive sublimate.

This is of academic interest now, as there are many excellent brands of catgut on the market, but it is interesting as showing that his search after truth continued with unabated vigour in the subject of catgut ligatures from 1868 until 1908.



Lister was the first medical peer and died in 1912, aged eighty-four. His memory is enshrined by the poet, William Henley, who was his patient for two years in the Edinburgh Royal Infirmary. Henley described these two years in a series of poems entitled "In Hospital," in which he paid the highest tribute to the Chief, as Lister was always called.

The history of dress in operating is obscure. We know that the old-time surgeon had a discarded frock coat in which he used to operate, the more stained and encrusted with blood from previous operations the better, and we are familiar to-day with the surgeon in white sterile gown, but the gradations between these two states are not so easy to trace. Lister did not dress in conformity with modern ideas. He took off his coat and pinned a towel over his waistcoat for his own protection, and Lawson Tait, we read, took off his coat and put on a large mackintosh apron, which it was quite impossible to render sterile. They both followed the same rule: they never spoke during an operation.

In 1891 we read in the *Manual of Operative Surgery* by Frederick Treves: "In the matter of dress the operator should be in his shirt sleeves with his arms bare and clothed from his collar to his feet in a simple mackintosh apron. The practice of wearing the ancient and discarded frock coat, which repeated operations have rendered stiff with blood, is not consistent with the rudiments of antiseptic surgery. If the surgeon must wear a coat, let it be an entirely new one. Sleeves of mackintosh or any other material are objectionable, clumsy, and in the way."

There are interesting illustrations in Castiglioni's *History of Medicine*. Gross is depicted operating in 1870 dressed in ordinary street clothes. About 1890 Hayes Agnew of Philadelphia and his assistants are seen in gowns, but no gloves or masks. In 1904 Halstead is depicted with a cap and rubber gloves, but no mask, and there is a picture of the modern technique, dated 1940, with even the spectators in gowns and masks. It is difficult, therefore, to state who deserves the credit for the adoption of gowns. In our own school they were certainly worn in the '90s.

The introduction of gloves has a flavour of romance about it. William Stewart Halstead, born in 1852 and afterwards surgeon at Johns Hopkins Hospital in Baltimore, deserves the credit. He was a follower of Lister with rather an aseptic approach. Many will recollect the severe treatment which was formerly considered essential for the disinfection of hands. Older men have described to me their sufferings as pupils and house surgeons, for corrosive sublimate was largely used, and it was especially severe when it was combined with instruments kept in shallow trays filled with carbolic acid. Halstead had a particularly rigorous method of disinfecting his hands and arms. He and his assistants started with a nail toilet, then scrubbed the hands for ten minutes with green soap and a nail-brush, plunged them into a saturated solution of permanganate of potash and kept them in it until they were stained a dark brown. The hands were then plunged into a warm solution of oxalic acid, which decolorized them again, after which they were immersed in corrosive sublimate solution. Small wonder that many of them got dermatitis.

Halstead had a theatre nurse working in his unit, whom he afterwards married,

a Miss Caroline Hampton, whose hands suffered severely from this regime. Halstead, on a visit to New York towards the end of 1889, called on the Goodyear Rubber Co., now famous for tyres, and asked them to make two pairs of thin rubber gloves with gauntlets, for Miss Hampton. These were boiled and used by her with the happiest results. Halstead was quick to realise that in addition to protecting the hands and arms from dermatitis, gloves would also protect the patient from infection from the hands, and thus arose the almost universal use of gloves.

It was not until the beginning of the century that they were used in this school. One who is present has described to me Professor Sinclair wearing them on the occasion of the excision of an anthrax pustule, but this was undoubtedly to protect himself. This was in January, 1900.

With the discovery of micro-organisms by Pasteur and the measures to control them introduced by Lister, theories of the cause of suppurative diseases and sepsis had to yield to established facts.

The hands, instruments, outdoor clothing of the surgeon and his assistants, were rendered innocuous, but it remained for the painstaking investigations of a German called Flügge in 1895 to discover another avenue of infection, for which so far no protection had been devised. Flügge proved that the bacteria found in the mouth and nose were not only pathogenic, but to quote a later investigator, Hübener, "that when speaking, coughing, and sneezing a spreading about of the mouth and nose secretions takes place." Even at a distance of several metres he had shown that agar plates were covered with colonies after somewhat louder and livelier speaking. Hübener's investigations were carried out in the Breslau Surgical Clinic of von Mikulicz-Rodecki, generally referred to as Mikulicz, and Mikulicz bent his energies to devise a plan to counteract this newly discovered source of infection.

In July, 1897, according to Professor Miles Phillips, who has gone very thoroughly into this question, he published a paper describing a "Mundebinde" (mouth bandage), which he used for this purpose. The material used was the finest mull, "sterilized of course," he says, "and fastened to the similarly sterilized operation gown."

This was a comparatively clumsy form of mask, and after further experiments a modified Esmarch chloroform mask, with spectacle ear-pieces carrying a double layer of close-meshed mull, was used. Mikulicz and Hübener found that the efficiency of the mask was greatly increased by wearing it a few centimetres from the face. This is now provided for by giving a snout-like projection to the mask, so that one breathes as it were into a bag. The Cestra mask used in the gynæcological wards of this hospital and the Royal Maternity Hospital are good examples of this type. Masks, which fit closely and tightly over the mouth and nose, are inefficient and may be a source of danger.

About the same time as Flügge, Hübener, and Mikulicz were investigating the question of oral sepsis, Paul Berger, a famous Paris surgeon, published a paper about the use of a mask in operating. He began with the statement, "For several

years I have been worried as to the part that drops of liquid projected from the mouths of the operator and his assistants may exercise on the outbreaks of infection, which one still sees from time to time under conditions of surgical asepsis, which are apparently satisfactory." Berger's suspicions had been aroused by the association of a short series of cases of suppuration in clean operations with an assistant who was suffering from an alveolar abscess. The same mishap occurred several months later when he himself was suffering from a dental periostitis. With his suspicions aroused he noticed that drops of saliva were projected from his own lips and those of his assistants when even simple monosyllabic orders were given. He was aware of Flügge's discovery and straightway set to work to shield his operation wounds from this cause of contamination, even before Mikulicz had published his paper. It would seem, therefore, that the credit for evolving the idea of the mask should be shared by these French and German surgeons. In our own school the first person to wear a mask was the late Robert Campbell. Using masks, he did a series of over one hundred cases of radical cure of inguinal hernia in infants at the turn of the century. As he expressed it, "There are so many people who cannot speak to you without spitting in your face," that it was necessary to protect open wounds during the progress of operations.

That the danger is a real one has been proved frequently in the last twenty years. In Hübener's original experiment fifty years ago an assistant whose mouth had been rinsed with a diluted culture of *bacillus prodigiosus* spoke and coughed at varying distances over appropriately arranged agar plates. As the prodigious colonies were coloured it was easy to distinguish the microbes projected from the mouth and those deposited by the air. The Doctors Colebrook, brother and sister, have proved the pathogenic nature of the flora of the respiratory passages, especially the occurrence of the hæmolytic streptococcus Type A. At Harvard University William and Mildred Wells have conducted experiments even more striking than Hübener's. In an air-conditioned room a "sneeze powder" was projected amongst a group of graduates. Bacterial samples of the air were collected by a centrifuge into blood agar tubes. In their own words this experiment showed "that under conditions of crowding in enclosed rooms we are breathing one another's naso-pharyngeal flora as we once drank each other's intestinal flora in our water supplies." Some die-hards still refuse to wear masks; let them think over these words.

It is customary in an introductory address to give some words of advice. This I hesitate to do, as when a student I was often in need of advice and exhortation myself. I remember lodging with a student who like myself came from County Derry, who always made good resolutions for the coming week on Sunday evening and advised me in the words of Milton: "To scorn delights and live laborious days." This mood usually lasted until Wednesday evening, then Thursday would find us at the Hippodrome or some such place of entertainment. Once we had slipped from grace, the rest of the week was frequently spent in a like manner. So we pursued our way until the middle of term, when we began to work in earnest and burned the midnight oil with a vengeance. I think the students of to-day work

harder than we did. Perhaps because there are so many new things to learn, but hard work pays good dividends. You will never regret it. But more than hard work is necessary. Be punctual at hospital, be tidy in your person, be kind and courteous to patients, remember that frequently the hospital will be judged by your conduct—you are its representatives. Take an interest in your patient. Remember that he or she is dear to someone and that it is only by the mercy of Providence that your positions are not reversed.

I have given you a short sketch of Semmelweiss, Lister, Halstead, and Mikulicz, and may it serve as an introduction to medical biography. There is no pleasanter method of learning medical history, and no man can consider himself educated who is ignorant of the great members of his own profession who have gone before, what they have attempted and what they have done. One of my teachers used to tell us that as an introduction to medical biography there were three books every medical student should read. They are: "The Life of Pasteur," The Memoirs and Letters of Sir James Paget, and Osler's "Aequanimitas." I followed this advice and never regretted it. There you learn of great achievements reached through earnest work. This is an age of rush and hurry when the great ideals of medicine are apt to be forgotten and it is well to look to these great men of a past age to see the difficulties they overcame when we are annoyed and exasperated by present-day conditions.

Nowadays in every sphere you all too often hear, "It will do well enough," "It's not so bad," or "I'll do it to-morrow." Never be content with anything short of the best. Sir Richard Livingstone, who was our Vice-Chancellor when I graduated, in a recent article has asked for an ideal of civilisation which in all fields of life aims at the first-rate. He says, "A man may show it in the way he grows flowers or vegetables, keeps bees, runs a factory or office, paints a picture, writes a book, or performs a surgical operation." You will agree that these are diverse occupations. Let your aim therefore be the first-rate. There are amongst you the future leaders of the profession, members no doubt of the staff of this hospital. Take yourselves seriously. According to Osler, than whom there is no better guide, the master word in medicine is "Work."

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